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PAPER

Habitat use and home range traits of resident and relocated hares (*Lepus europaeus*, Pallas)

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Abstract

The aim of the study was to identify the habitat preferences and home range of resident and relocated brown hares during the no-hunting period. The trial was carried out in a protected area and in a free-hunting territory (FHT), both located in the Florence province. During the captures, 21 hares were equipped with a necklace radio-tag: seven hares (resident group) were released in the same area of capture and 14 hares (relocated group) were relocated in six different locations within the FHT. The effect of the place of release was analysed by ANOVA and/or nonparametric methods. Results showed that the home ranges of the resident group were characterized by a greater amount of fallow land and shrub land than of the relocated group ($P<0.05$). Home range sizes and maximum distances from the releasing sites were greater in the relocated group. Resident hares preferred landscape characterized by a higher density of patches (152 vs. 70 n/100 ha), patch richness (43 vs. 12 n/100 ha), and patch area (4703 vs. 8142 m^2) than the relocated hares ($P<0.01$). The landscape structure indices, the home range sizes and the maximum distance from the releasing sites suggest that the relocated hares, even if released in suitable habitats, will move from their releasing point to look for better habitats. The landscape with the most complexity is preferred by the resident hares. This result should be considered when a project is programmed to reintroduce this lagomorph into a territory, or when it is necessary to improve the dynamics of a natural population.

Introduction

The landscape ecology, developed from the studies of Forman and Godron (1986) and Forman (1995), may be very useful for game managers, who can modify the land use of managed areas to increase the fitness of the habitat for wildlife. The studies of the landscape, at first, were interesting for general and descriptive aspects of the agricultural-wooded territories (Legendre and Fortin, 1989; Turner, 1990; Gardner *et al*., 1993; Baskent and Jordan, 1995; Fjellstad *et al*., 2001), then were used to compare different zones or the development of the same zone. Studies on the habitats and populations of wild fauna were produced later, using the landscape structure analysis (Fahrig and Merrian, 1985; Fahrig and Paloheimo, 1988; Dunning *et al*., 1992; Johnson *et al*., 1992; Anderson and Gutzwiller, 1994; Danielson and Anderson, 1999; With, 1999). The influences of the territory space-structure were investigated on single species and their home-range (Temple, 1986; Haila *et al*., 1987; Robbins *et al*., 1989; McGarigal and McComb 1995; Clark, 1999; Glennon and Porter, 1999; Kie *et al*., 2001; Fearer and Stauffer, 2004; Said and Servanty, 2005; Jimenez-Garcia *et al*., 2006; Belda *et al*., 2007; Martinez-Perez *et al*., 2007). Different authors produced a series of indices (landscape ecology metrics, LEM) to estimate the space structure of the territory (Shannon and Weaver, 1949; Simpson, 1949; O'Neill *et al*., 1988; Gustafson and Parker, 1992; Li and Reynolds, 1995; Ritters *et al*., 1995; Gustafson, 1998; Hargis *et al*., 1998; Jaeger 2000). Landscape ecology metrics, at present, are easily computable through suitable software or through existing extension of the GIS software (McGarigal and Marks, 1995; ESRI, 1996; Elkie *et al*., 1999), so that studies on the environmental preferences of a species, which could be useful in supplying indications to game managers, can be carried out easily in limited and homogeneous climatic-vegetation areas.

The Italian legislation (Law 157/92, article 10) and later that of regional areas (Tuscany Regional Law 3/94, article 16) have identified small protected areas (PAs) to be intensively managed like the sites deputized to the maintenance and increase of the wild resident populations (mainly hares and pheasants). Inside the PAs, the releasing of reared animals is not allowed, and the game manager can only modify the habitat and relocate wild-born animals between PAs to manage the populations. The natural dispersion of wild resident populations outside of the perimeters of the PAs and the capture of wild subjects with their relocation in the low-density free-hunting territories (FHTs) are used to maintain the right population density. The capture and relocation of the hares are necessary because only 20-30% of the Italian territory may, by law, be converted to PAs and, consequently, the natural dispersal may not be sufficient to involve the remaining FHTs (Bray *et al*., 2007). In the Mediterranean habitat, the studies on the inherent aspects of space use by the hares report only partial data related to very wide and diversified territories, or show the preferences of the hares in fenced areas (Reitz and Leonard, 1994; Santilli *et al*., 2004; Santilli and Galardi, 2006; Ferretti *et al*., 2008; Paci *et al*., 2008; Zaccaroni *et al*., 2008). For these reasons we wanted to study the spatial structure and the habitat preference of the hares living in the hilly Mediterranean habitat, comparing the spatial structure and the habitat preference of the resident hares with that of the relocated hares.

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Materials and methods

The trial was carried out in a PA of 762 hectares, called Bracciatica (X=1667003, Y=4844543; ref. Rome, 1940) and in an FHT of 649 hectares, called Lastra a Signa (X= 1667444, Y=4847755; ref. Rome, 1940), both located in the Florence province. The two agricultural areas were characterized by a good habitat variety and medium/small fields

(Shannon diversity index 1.96 and 1.74, patch area 1.82 and 1.58, respectively). The crops mostly present were vineyards (*Vitis vinifera* L.), olive-yards (*Olea europaea* L.) and, secondarily, autumn cereals (mainly wheat: *Triticum aestivum* L. and oats: *Avena sativa* L.), alfalfa (*Medicago sativa* L.) and spring crops (sunflower: *Helianthus annuus* L., jowar: *Sorghum vulgare* L., and corn: *Zea mays* L.). In the PA some habitat enhancements, established essentially by the so-called "crops-for-game" (no-harvested crops) method, were also realized and were mainly strips sown with mixtures of jowar, rape (*Brassica napus* L. var. *oleifera*) and sunflower in the spring and broad bean (*Vicia faba* L. var. minor) and wheat in the autumn, both left on the field without any weed control. Both the areas were characterized by much spontaneous vegetation (Table 1, Figures 1 and 2).

A self-sustaining population of about 220 wild hares (28.9 hares per 100 ha) was estimated in the PA by driver spot-light census (Frylestam, 1981; Barnes and Tapper, 1985) carried out before the capture operations (12% of the surface lighted in December/January) (Table 2). No hare was observed in the FHT after the end of the hunting season. In January 2007, during the capture, 21 hares (adult females, Stroh's tubercle absent, weighing 3600±167.3) were equipped with a necklace radio-tag (Biotrak, TW3+ ½AA, 32.30 g) and an immovable auricular tag; seven of these hares (resident group) were released in the same area of capture (Figure 1) and 14 of the hares (relocated group) were released in six different locations within the FHT (Figure 2). A blinking device (Bagliacca *et al*., 2008) was used to reduce subclinical stress in the hares to be released.

The hares were localized and sighted during the day, at least 2-3 times a week in January to August (212-fix total), by two receivers equipped with four-element Yagi antennae, binoculars and a walkie-talkie (Kenward, 1993). Six radio fixes were obtained by taking synchronous compass bearings from at least two different positions localized on the top of the hills at a range of 300-500 m; 131 fixes were obtained after controlling for the presence of the hare in the triangulated patch; 75 fixes were obtained by direct sighting of the hare during the control of its presence in the triangulated patch. For each fix, the time and the land use were registered, either on a sheet or on a GPS portable device (Garmin eTrex Legend navigator; 1-5 m location error). Subsequently, the data (GPS-Utility Ltd. 1998-2006) were transferred onto geo-referencing software (ArcView®-ESRI), in which the land-

Table 1. Land-use classification and landscape ecology metrics of the different study areas (official web site of the Region Toscana Government, integrated and corrected by the use of aerial photographs 1:10000 digitalized and georeferenced).

	PA			FHT		
	ha	%	Tot %	ha	%	Tot %
Land use						
Mediterranean wood	122	16.0	16.0	209	32.2	32.2
Fallow land	145	19.0		65	10.0	
Shrub land	38	5.0	24.0	28	4.3	14.3
Fruit-tree orchards and poplars	3	0.4		2	0.3	
Olive orchards	140	18.4	18.8	176	27.1	27.4
Crops-for-game	10	1.3		0	0	
Orchards and gardens	2	0.3		2	0.3	
Grasses and pastures	14	1.8		6	0.9	
Winter cereals	64	8.4		20	3.1	
Spring cereals	2	0.3	12.1	1	0.2	4.5
Vineyards	161	21.1	21.1	92	14.2	14.2
Extractive and construction sites	2	0.3		0	0	
Rivers and ponds	1	0.1		1	0.2	
Urban areas	58	7.6	8.0	47	7.2	7.4
Total	762	100.0	100.0	649	100.0	100.0
Landscape ecology metrics						
Patches, no.		419			412	
Patch density, no./100 ha		55			64	
Total edge of patches, km		181			153	
Edge density of patches, no./100 ha		239			254	
Patch richness, npat		13			12	
Patch richness density, no./100 ha		1.84			1.85	
Patches area, ha		1.82			1.58	
Landscape shape index		18.5			16.9	
Fractal dimension index		1.11			1.11	
Shape index		1.68			1.63	
Contagion index, %		56.6			59.97	
Aggregation index, %		94.8			94.82	
Interspersion and juxtaposition index, %		72.5			70.39	
Landscape division index		0.98			0.91	
Shannon's diversity index		1.96			1.74	
Shannon's evenness index		0.77			0.71	

PA, protected area; FHT, free-hunting territory.

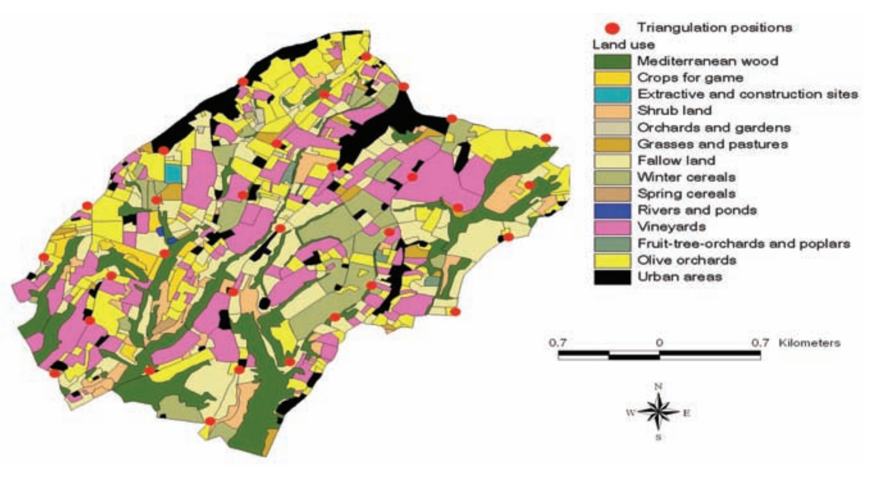

Figure 1. Land uses in the protected area.

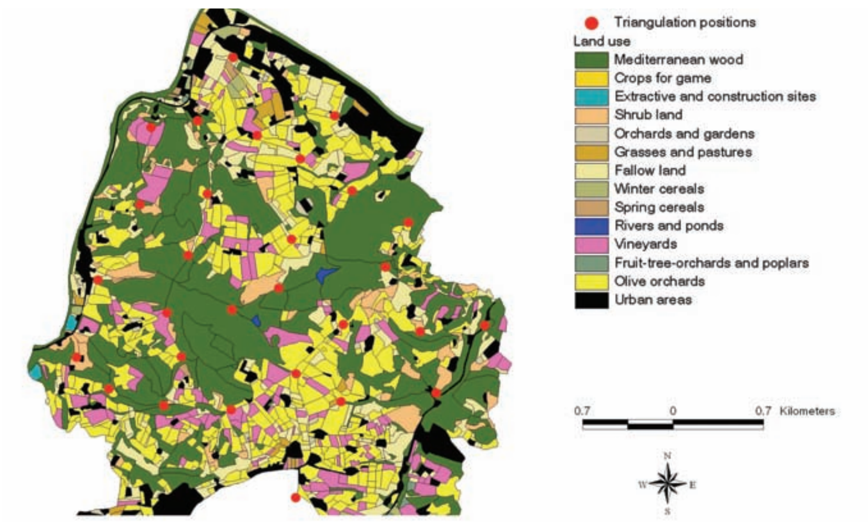

Figure 2. Land uses in the free-hunting territory.

Table 2. Hare captured in or part of the census of the protected area in the different years.

Years	Spotlight strip census before capture*, n/km^2	Captured and relocated outside the PA, n/km^2	Spotlight strip census after capture, n/km^2	Complete flush count in standardized areas (with dog-help in summer), n/km^2
2001	33.7	9.9	22.5	13.6
2002	26.4	6.8	33.7	15.1
2003	23.9	7.5	11.2	13.1
2004	27.7	8.6	23.9	21.6
2005	18.9	5.9	16.4	16.2
2006	29.6	7.6	18.9	14.0
2007	22.2	2.6	23.6	15.1
mean	26.1	7.0	21.4	15.5
SD	4.91	2.33	7.06	2.87

* Paci *et al.*, 2007; PA, protected area; FHT, free-hunting territory.

use maps of the PA and FHT had been loaded previously. The fourteen originally checked land uses were grouped into six main categories using expert knowledge (Table 1). At the end of the trial, the mortality rate was 42.9% (six hares) in the FHT and 28.6% (two hares) in the PA (no significant difference; χ^2=0.03).

Habitat use

The home ranges and the habitat composition were calculated by the Minimum Convex Polygon (MCP) method using the Spatial Analysis® ArcView®-ESRI GIS-software and the Animal Movement extension (Hooge and Eichenlaub, 1997). For the resident hares, the surface of the study area was identified with the surface of the PA, and for the relocated hares, the surface of the study area was identified with the surface of the total MCP (increased by 5%).

The proportional habitat use was calculated according to the following formulae:

$$\text{Proportional habitat presence in the home range} = \frac{\dfrac{\text{Surface of habitat in MCP of hare}}{\text{Surface of MCP of hare}}}{\dfrac{\text{Surface of habitat in the study area}}{\text{Surface of the study area, total}}}$$

$$\text{Proportional habitat use within the home range} = \frac{\dfrac{\text{Number of fixes in habitat of hare}}{\text{Number of fixis of hare}}}{\dfrac{\text{Surface of habitat in MCP of hare}}{\text{Surface of MCP of hare, total}}}$$

The data, opportunely codified (ln-values), were analyzed by ANOVA, considering the place of release as the main effect (Pendleton *et al*., 1998; SAS, 2002); 0% utilization of an available habitat type was replaced by 0.01% (Aebisher *et al*., 1993).

Movements, home range size and landscape structure of resident and relocated brown hares

Home range (either Kernel or MCP methods), maximum, minimum and average daily movements, maximum distances from the releasing sites and from the centroid were calculated for relocated and resident hares, respectively (Hooge and Eichenlaub, 1997). The LEM were calculated for the home range according to Fearer and Stauffer (2004) using Fragstat 3.3 software (McGarigal and Marks, 1995) after the rasterization process (Jimenez-Garcia *et al*., 2006). The LEM were analyzed either as absolute or relative values by the nonparametric method (Wilcoxon rank scores). Wilcoxon rank scores between resident and relocated hares were compared using the LEM of the hares and the LEM of the available habitats (SAS, 2002).

Results and discussion

Habitat use

Table 3 shows the data concerning the land uses selected by the hares. The fallow land and shrub land were more represented within the home ranges of every hare when compared with their relative importance in the area, 1st rank. The home ranges of the relocated group were characterized by a greater presence of woods, fruit trees and olive orchards compared with their incidence (1.5-1.4 times more in the home range than in the FHT, 1st rank). The home ranges of the resident group were characterized by a greater presence of fallow land and shrub land compared with their incidence (2.8 times more in the home range than in the PA, 1st rank); any other environment representing less than its relative availability.

The fix locations of the hares within their home range are shown in Table 4. The crops-for-game, orchards, pastures and cereals were constantly classified as 1st rank. No fix was observed during the trial in the artificial areas (extractive, construction sites and urban areas) or river and ponds.

The results confirm the general habitat preference of the hares reported by other authors (Genghini and Capizzi, 2005; Trocchi and Riga, 2005). In particular, the hares chose home ranges with a higher incidence of fallow land and shrub land than that available, probably because these areas represent the best refuges for the species, as they are characterized by low-level permanent cover (Angelici *et al*., 1999; Smith *et al*., 2005).

The mixed environments (crops-for-game, orchards, pastures and cereals), even if they represent the typical feeding areas for the hare (Pandini *et al*., 1998; Smith *et al*., 2005), were represented less in the home range. Small surfaces of mixed environments bordering the refuge areas seem to be more than enough for the requirements of the hares in the Mediterranean habitat. In addition, the fixes of the hares were often found near field edges where vegetation was different (Meriggi and Alieri, 1989; Lewandovski and Nowakowski 1993; Vaughan *et al*., 2003).

The significantly greater presence of hares in the Mediterranean woods and the olive orchards, having been released into an unknown, new environment (relocated group), may be explained by the fact that these land uses represent the environments with the lowest human presence during this period. The Mediterranean woods are generally not frequented by humans and the olive orchards are characterized by no tillage or grass cutting, at least from mid January to the end of May. Thus, the Mediterranean small woodlands that characterize the FHT landscape provide cover for the foreign hares. These hares, which do not know the habitat into which they are forcedly released, probably choose their home range in relation to the presence of cover and the absence of human presence.

The fallow land and shrub land, which generally are preferred by the hares, may be used less than their availability by the relocated hares because this new, unknown habitat may represent a risk for a possible predator presence. These areas, in fact, may provide cover for foxes (*Vulpes vulpes*).

The artificial areas (extractive and construction sites and urban areas), rivers and ponds can be included in the home range of the hares, as also observed by other authors (Pandini *et al*., 1998; Pella and Meriggi, 2007). These areas, however, even if included in the home range of the hares were confirmed as not entering into the vital area of the hares (fixed not observed), and should be omitted from the calculation of the surfaces selected for the wild hare reproduction where game managers forbid hunting.

Table 3. Land use partition in the hare home range (Minimum Convex Polygon method) in respect to the overall land use partition (analysis carried out on in-values; Aebischer *et al.*, 1993) (least square means ± SE).

	Resident	Relocated	Overall values	Resident ranks	Relocated	Overall values
Mediterranean wood	0.4±0.27	1.5±0.17	0.9±0.16	2nd	1st	2nd
Fallow land and shrub land	2.8±0.27	0.8±0.17	1.8±0.16	1st	2nd	1st
Tree and olive orchards	0.8±0.27	1.4±0.17	1.1±0.16	2nd	1st	2nd
Crops-for-game, orchards, pastures and cereals	<0.1±0.27	0.3±0.17	0.2±0.16	3rd	3rd	3rd
Urban areas, extr./constr. sites, rivers and ponds	0.8±0.27	0.3±0.17	0.6±0.16	2nd	3rd	3rd
Vineyards	0.9±0.27	0.5±0.17	0.7±0.16	2nd	2nd	2nd

Ranks differ per P<0.05; considering that least square means >1 show a larger incidence of the land use in the home range than in the study area; considering that least square means <1 show a smaller incidence of the land use in the home range than in the study area; extr./constr: extractive/construction.

Table 4. Land use location of the hare fixes in respect to the land use incidence in the home range calculated with the Minimum Convex Polygon method (analysis on in-values; Aebischer *et al.*, 1993) (least square means ± SE).

	Resident	Relocated	Overall values	Resident ranks	Relocated	Overall values
Mediterranean wood	1.2±5.31	3.0±3.28	2.1±3.12	2nd	nc	2nd
Fallow land and shrub land	1.3±5.31	0.9±3.28	1.1±3.12	2nd	nc	2nd
Tree and olive orchards	0.2±5.31	0.9±3.28	0.5±3.12	2nd	nc	2nd
Crops-for-game, orchards, pastures and cereals	>10±5.31	7.1±3.28	>10±3.12	1st	nc	1st
Urban areas, extr./constr. sites, rivers and ponds	<0.1±5.31	<0.1±3.28	<0.1±3.12	2nd	nc	2nd
Vineyards	1.1±5.31	2.4±3.28	1.8±3.12	2nd	nc	2nd

Ranks differ per P<0.05; considering that least square means >1 show a larger incidence of the land use in the home range than in the study area; considering that least square means <1 show a smaller incidence of the land. nc, No rank difference.

Table 5. Movements and home ranges features of PA-resident and FHT-relocated hares (mean ± SD).

	Resident		Relocated		Relative LEM: resident *vs* relocated
Max distance, m	368±324	b	1.281±251	a	
Min daily movements, m/day	12±6.5		10±5.0		
Max daily movements, m/day	345±76		321±59		
Average daily movements, m/day	35±11.9		53±9.2		
Kernel 95 home range, ha	23±76.8	b	173±59	a	
MCP home range, ha	9±25.28	b	63±19.58	a	
Landscape ecology metrics					
Patch in the home range, n	31±40.0		106±31.0		<1
Patches density in the home range, n/100 ha	152±12.4	A	70±9.6	B	>1
Total edge of patches, km	9.7±16.2		39.8±12.6		<1
Edge density of patches, n/100 ha	448±21.0	A	258±16.2	B	≥1
Patch richness, n	8±1.0		9±0.8		<1
Patch richness density, n/100 ha	43±6.0	A	12±4.6	B	>1
Patch area, m^2	4703±601	B	8142±466	A	≤1
Landscape shape index	5.0±1.23		6.9±0.96		<1
Fractal dimension index	1.121±0.0037	A	1.108±0.0027	B	≥1
Shape index	1.633±0.0355		1.585±0.0262		≥1
Contagion index, %	54±1.8	B	61±1.4	A	≤1
Aggregation index, %	93±0.3	B	96±0.2	A	≤1
Interspersion and juxtaposition index, %	75±1.7		75±1.3		≤1
Landscape division index	0.91±0.033	a	0.81±0.025	b	>1
Shannon's diversity index	1.60±0.088		1.47±0.068		≤1
Shannon's evenness index	0.77±0.035		0.70±0.027		≥1

a,b: P<0.05; A,B: P<0.01; LEM: landscape ecology metrics; considering that relative LEM <1 show a statistically significant increase of the relative value in the relocated; considering that relative LEM >1 show a statistically significant decrease of the relative value in the relocated; ≤1 or ≥1 show no statistically significant increase of the relative value in the relocated.

Movements, home range size and landscape structure of resident and relocated brown hares

The movements and home range analysis between the two groups are reported in Table 5. As suspected, the dispersion of relocated animals was higher: double the value of the maximum distance from centroid observed in the resident group (1.281 vs. 736 m, P<0.05). The home range size of the relocated group was larger than that of the resident group (Kernel: 173 vs. 23 ha, MCP: 63 vs. 9 ha, P< 0.05). Regarding the absolute value of LEM, the preliminary study of the patches that constitute the home ranges of the two groups showed significant differences: the resident hares showed greater patch density, patch richness density and lower patch areas than the relocated hares (152 vs. 70n/100 ha, 43 vs. 12 n/100 ha, 4703 vs. 8142 m^2, respectively, P<0.01). The resident hares showed a greater density of length of the margins than relocated hares and also a greater Fractal dimension index (448 vs. 258 m/ha, 1.121 vs. 1108, P<0.01).

The contagion and aggregation indices were lower in the resident hares than relocated hares (54 vs. 61%, 93 vs. 96%, P<0.01), whereas the landscape division index was greater in the resident hares than relocated hares (0.91 vs. 0.81). The relative data generally reflected the absolute value in the order of the proportion between the two groups (except the interspersion and juxtaposition indices and Shannon's diversity index, which are inverse), but the various indices were significantly different. Relative LEM showed a significant effect of treatment for number of patches in the home range, patches density in the home range, total edge of patch, edge density of patches, patch richness, patch richness density, landscape shape index and landscape division index. The indices with the statistically significant difference in absolute and relative mode were: patch density in the home range, patch richness density and landscape division index.

The modified behaviour induced by the translocation may be because of either searching for the natal territory or of worse habitat quality of the FHT. The habitat of the PA and FHT, in fact, were similar but not exactly the same. The PA had been identified and extracted by the institutions deputized to wildlife management, like an area theoretically programmed particularly for hare wildlife reproduction and not randomly selected within the Florence province. The FHT, in addition, is a new habitat unknown to the hares, so that the relocated hares have to wander to find the open dens that they need to remain safely crouched during the day.

The significantly greater maximum distance from the releasing sites for the relocated hares was double the maximum distance from centroid observed in the resident hares, even if the daily movements do not change between the two groups of animals. This fact seems to show that the translocation leads the animals to significantly larger movements; the home range of the resident hares was comparable to or lower than that observed in different landscapes by other authors (Broekhiuzen and Maaskamo, 1982; Ruhe and Hoffmann, 2004). The larger home range observed in the relocated hares compared to the average value observed in the resident hares (Smith *et al*., 2005) may be because of the lower density of hares in the FHT and not only to the search for a territory with features like that of their origin. The use of the absolute values of LEM, calculated on the home ranges of the animals to estimate the space structure of the territory of animals from different categories, may lead to incorrect evaluations as they are completely independent from any measure of habitat availability. The principle of proportional habitat use by individual animals must be applied to the study of LEM However, absolute and relative data analysis shows, in this case, generally similar results or at least suggests some unambiguous direction of the study.

The resident hares seem to prefer a territory with a higher number of patches and typology of patch than do the relocated hares. In addition, the indices that concern the edges suggest this. The hares that were born and lived in the same territory use the best area possible, a landscape with signs of the typically hilly Tuscany agriculture (mosaic agriculture). Areas containing several small patches of appropriate cover types should provide the habitat diversity that the hares require throughout the year. In fact, a mixture of landscape elements provides a wide range of spatial resources (breeding, rest, etc.). The relocated hares do not know the new territory and search for the best area possible, having to be content with the features of the new zone (food, water, no predator killing). As the hares have to move more through their home range, their exposure to predators as well as their overall energy expenditure may increase, leaving them more vulnerable to mortality. This may be especially important during the winter and early spring months as food supplies become limited and the hares are more exposed owing to decreased foliage cover.

The contagion index and other related indices (Aggregation and Landscape Division) showed an important result. The index is the observed contagion over the maximum possible contagion for the given number of patch types. The contagion index is inversely related to edge density. When edge density is very low, for example, when a single class occupies a very large percentage of the landscape, contagion is high, and vice versa. In addition, contagion is affected by both the dispersion and interspersion of patch types. The results show that the resident hares prefer a habitat with the most mixture and complexity than do the relocated ones. This confirms the data about the choice of the "perfect territory" by the resident hares vs. those hares relocated into a different zone.

Conclusions

The different habitat choices of the resident and relocated hares must be taken into consideration when the public game managers trace the borders of the PAs within the FHTs. Even if crops-for-game, orchards, pastures and cereals are commonly considered the best habitats for the hares, it is evident that small surfaces seem more than enough to satisfy the requirements of the hares, as their incidence in the hare home ranges were always found to be lower than their availability in the landscape. The presence and the increase of the fallow land and shrub land seem the most important factors for the resident hares, at least for refuges during the day. On the other hand, when the hares do not know the habitat (relocated animals), the animals seem to prefer areas covered by many small Mediterranean woods, fruit-trees and olive orchards. The absence of any human presence seems to be the most important factor for the relocated hares, which the game managers must consider when they decide on the location sites for the releases.

The dimension of the home ranges of the hares in the PA, measured after the capture operations with the consequent density reduction owing to the transfer of some animals, confirms that the hares probably guarantee the dispersion in the bordering territories only with their offspring. This fact must be considered when the game managers calculate the demographic parameters within the PAs. The operations of trapping and translocation may be good methods, not only for the aim of increasing the hare presence in the non-bordering territories but also to clear space for the offspring within the PAs. The landscape structure indices, the home range sizes and the maximum distance from the releasing sites suggest, however, that the relocated hares, even if released into suitable habitats, will move from ther releasing point to look for better habitats, increasing the risk of being killed by predators or by vehicles while crossing roads. Landscape with the most complexity is preferred by the resident hares and this result should be considered when a project to reintroduce this lagomorph into a territory is programmed, or when it is necessary to improve the dynamics of a natural population.

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